REMARKS

1. Applicant wishes to thank Examiner for the courteous and helpful telephonic interview conducted on July 22, 2002 regarding the present application and another copending application.

2. Claim 5 was objected to for having an additional period at the end of the claim.

3. Claim 5 has been amended to correct the informalities noted.

4. Claims 1, 5, 8-11, 13-15 and 19 were rejected under 35 U.S.C. § 102(b) as anticipated by Hearst et al. (US 3,536,058).

5. Base claim 1, and therefore all of the claims, distinguish over Hearst et al. (US 3,536,058) by recitation of the novel combination of an article of clothing for use in a cold environment utilizing a phase change thermal storage material with a phase transition temperature that is between the environmental temperature and normal skin temperature and which is equal to or less than 82 degrees Fahrenheit in order to provide a thermal environment at a temperature above the ambient temperature for an extended period of time, and to provide a heat sink to absorb metabolic heat, the absorbed metabolic heat acting to recharge the phase change material, to thereby increase the time period for which the thermal storage material provides the thermal environment at a temperature above the ambient environmental temperature.

Hearst et al. (US 3,536,058) discloses a protective suit for divers that utilizes a phase change material with a transition temperature of 86 degrees Fahrenheit (29.9 C). Hearst et al. do not disclose an article of clothing utilizing a phase change thermal storage material with a phase transition temperature that is between the environmental temperature and normal skin temperature and which is equal to or less than 82 degrees Fahrenheit.

Claims 1, 5, 8-11, 13-15 and 19 are therefore submitted as being patentable over Hearst et al. (US 3,536,058) under 35 U.S.C. § 102(b).

6. Claims 1, 2, 4, 5, 8, 9 and 11-13 were rejected under 35 U.S.C. § 102(b) as anticipated by Bryant et al. (US 4,756,958).

7. Base claim 1, and therefore all of the claims, distinguish over Bryant et al. (US 4,756,958) by recitation of the novel combination of an article of clothing for use in a cold environment utilizing a phase change thermal storage material with a phase transition temperature that is between the environmental temperature and normal skin temperature and which is equal to or less than 82 degrees Fahrenheit in order to provide a thermal environment at a temperature above the ambient temperature for an extended period of time, and to provide a heat sink to absorb metabolic heat, the absorbed metabolic heat acting to recharge the phase change material, to thereby increase the time period for which the thermal storage material provides the thermal environment at a temperature above the ambient environmental temperature.

The disclosure of Bryant et al. (US 4,756,958) is in keeping with the conventional wisdom at the time the present invention was made, which is that, for thermal comfort in a cold environment, a garment utilizing a phase change thermal storage material must have a phase transition temperature at or above normal skin temperature. Although Bryant et al. (US 4,756,958) disclose phase change materials with phase transition temperatures below normal skin temperature, these are contemplated only for providing body cooling in a hot environment.

In describing the function of the thermal storage fibers, Bryant et al. (US 4,756,958) state in column 4, lines 14-42:

> In another important aspect of the invention, a fabric can be formed from the fibers described above by conventional weaving, knitting or nonwoven methods. For example, in a woven fabric any combination of the warp and weft with or without microcapsules can be used in order to obtain the desired texture and durability. This fabric may then be used to

> fabricate temperature adaptable clothing and other thermal barriers. For example, protective gloves can be made from the fabric. By choosing an appropriate phase change material, the gloves can be adapted for cold weather use. The gloves can be placed in a heating chamber prior to use to liquify the phase change material. When it is desired to use the gloves, they are removed from the chamber and they will remain warm for an extended period of time. Substantial cooling will not occur until the liquid phase change material has solidified. Conversely, by selecting the appropriate phase change material, the gloves can be used to handle hot objects. In this situation the gloves are cooled and a phase change material is solidified. When the gloves are exposed to a hot surface, the user will remain comfortable as he will perceive that they are remaining cool. This continues until the phase change material has liquified. The reader will note that this concept can be applied to numerous applications including items of clothing such as shoes, environmental suits as well as other applications which require shielding of individuals or machinery from the hot and cold.

This is reflective of the conventional wisdom that protection in a cold environment requires a phase transition temperature above skin temperature and that protection in a hot environment requires a phase transition temperature below skin temperature. Nowhere in Bryant et al. (US 4,756,958) does it disclose or suggest the use of the disclosed thermal storage fibers for protection of a user in a cold environment by providing a phase change material with a transition temperature between the skin temperature and the ambient environmental temperature.

The idea of using a low transition temperature phase change material for protection in a cold environment is very counter-intuitive. Let us look a deeper look at why this counter-intuitive solution is so inventive. The goal of the invention is to provide a comfortable personal environment for a user in a cold ambient environment over an extended period of time, preferably with the least weight of phase change material possible. The conventional solution is to provide a phase change material with a transition temperature above skin temperature, whereas the claimed invention calls for a phase change material with a transition temperature between the skin temperature and the ambient environmental temperature.

For the sake of illustration let's apply some real numbers to this example. First let's set the ambient temperature at 40° F. Next, let's pick two PCM's, one with a transition temperature above skin temperature and another with a transition temperature between the skin temperature and the ambient environmental temperature. To make it fair we'll pick two PCM's with approximately the same latent heat of phase change, for example, n-tricosane with a transition temperature of 117.5° F and a latent heat of 100 Btu/lbm and n-hexadecane with a transition temperature of 62.1° F and a latent heat of 102 BTU/lbm. We'll make a first flexible composite material vest with 10 pounds of n-tricosane, having a total latent heat of phase change of 1000 BTU, and a second flexible composite material vest with 9.8 pounds of n-hexadecane, also having a total latent heat of phase change of 1000 BTU. Both vests are made with an outer insulating layer of approximately equal insulating value and an inner insulating layer of approximately equal insulating value to adjust the skin contact temperature down or up, respectively, to a comfortable range. Then, we will charge up these two vests, put them on two users and thrust them out into the cold environment.

At first, both users are toasty and warm. As expected though, both vests start to lose heat to the cold environment. Assuming the outer insulating layers of the vests have approximately equal insulating value, the rate of heat loss from the PCM to the environment will be proportional to the temperature difference. The temperature difference between the first PCM and the environment is 77.5° F, and the temperature difference between the second PCM and the environment is 22.1° F. This means that the vest with the high temperature PCM will be losing heat to the cold environment three and a half times faster than the vest with the lower temperature PCM having a transition temperature between skin temperature and the ambient environmental temperature. In a relatively short time, the latent heat stored in the high temperature PCM will be exhausted and the temperature will start to drop, while the latent heat in the lower temperature PCM will maintain a steady temperature three and a half times longer. Ignoring the difference in sensible heat stored, which is negligible compared to the latent heat stored, the lower temperature PCM vest will keep the user at a comfortable temperature for three and a half times as long. This is totally counter-intuitive, that by choosing a PCM with a lower

transition temperature, the vest can maintain a user at a warm comfortable temperature for many times longer, and even without taking self-regeneration into account.

Self-regeneration of the lower temperature PCM will stretch this advantage even farther. Because the PCM has a transition temperature significantly below normal skin temperature, it will absorb excess metabolic heat from the user, which will recharge the latent heat of the PCM at the same time it is losing heat to the colder environment, thereby extending the comfort period for the user. The more vigorous the user's activities are, the more effect this self-regeneration principle will have. In addition, because this excess metabolic heat is converted into latent heat, it reduces the rate of heat loss to the environment. If the excess metabolic heat were absorbed as sensible heat it would raise the temperature of the PCM and increase the rate of heat loss to the environment.

Because the higher temperature PCM has a transition temperature above skin temperature, it cannot take advantage of this self-regeneration principle. Once the PCM temperature drops below the user's skin temperature it will start to absorb excess metabolic heat from the user as sensible heat, but it will not recharge the PCM, and the PCM will not act to reduce the rate of heat loss to the environment.

In conclusion, this novel and nonobvious method of protecting a user in a cold environment by providing a phase change material with a transition temperature between the skin temperature and the ambient environmental temperature is not disclosed or suggested by Bryant et al. (US 4,756,958). This solution is counter-intuitive and counter to the conventional thinking in this field at the time the invention was made. Furthermore, this unconventional solution gives Applicant's invention totally unexpected performance which far exceeds the performance of the prior art that uses more conventional solutions to the same problem.

The claimed invention also exhibits an additional benefit not achieved by the prior art, which is that for phase change materials with a phase transition temperature below normal room temperature, the thermal storage material can be regenerated at room

temperature without special equipment, such as the heating chamber needed to regenerate the phase change materials in the thermal storage fibers of Bryant et al. (US 4,756,958) as described above.

For all these reasons, applicant submits that claims 1, 2, 4, 5, 8, 9 and 11-13 are patentable over Bryant et al. (US 4,756,958) under 35 U.S.C. § 102(b).

8. Claims 1, 5, 8, 9, 11 and 13-16 were rejected under 35 U.S.C. § 102(b) as anticipated by Senee et al. (US 4,894,931).

9. Base claim 1 and therefore all of the claims distinguish over Senee et al. (US 4,894,931) by recitation of the novel combination of an article of clothing for use in a cold environment utilizing a phase change thermal storage material with a phase transition temperature that is between the environmental temperature and normal skin temperature and which is equal to or less than 82 degrees Fahrenheit in order to provide a thermal environment at a temperature above the ambient temperature for an extended period of time, and to provide a heat sink to absorb metabolic heat, the absorbed metabolic heat acting to recharge the phase change material, to thereby increase the time period for which the thermal storage material provides the thermal environment at a temperature above the ambient environmental temperature.

Senee et al. (US 4,894,931) disclose a heating device for footwear containing a phase change thermal storage material with a transition temperature in the range of 30 to 40 degrees Centigrade (86-104 degrees Fahrenheit), which does not meet the claim limitations. Therefore, claims 1, 5, 8, 9, 11 and 13-18 are submitted as being patentable over Senee et al. (US 4,894,931) under 35 U.S.C. § 102(b).

10. Claims 1, 5, 8, 9, 11 and 13-16 were rejected under 35 U.S.C. § 102(e) as anticipated by Bryant et al. (US 5,499,460).

11. Applicant respectfully requests that Examiner withdraw all rejections of the claims based on Bryant et al. (US 5,499,460) because this reference is not prior art to the present application.

The present application has a priority date of July 14, 1992, based on the original filing date of the parent application. In accordance with M.P.E.P. § 2136.03 (IV), the Bryant et al. (US 5,499,460) reference is entitled to a 35 U.S.C. § 102(e) date of July 13, 1994, based on the filing date of the continuation-in-part application. The Bryant et al. (US 5,499,460) reference is therefore not prior art to the present application under 35 U.S.C. § 102(e).

M.P.E.P. § 2136.03(IV) states:

> "IV. PARENT'S FILING DATE WHEN REFERENCE IS A CONTINUATION-IN-PART OF THE PARENT
>
> *Filing Date of U.S. Parent Application Can Only Be Used as the 35 U.S.C. 102(E) Date If It Supports the Claims of the Issued Child*
>
> In order to carry back the 35 U.S.C. 102(e) critical date of the U.S. patent reference to the filing date of a parent application, the parent application must (A) have a right of priority to the earlier date under 35 U.S.C. 120 and (B) support the invention as claimed as required by 35 U.S.C. 112, first paragraph. "For if a patent could not theoretically have issued the day the application was filed, it is not entitled to be used against another as 'secret prior art' " under 35 U.S.C. 102(e). *In re Wertheim* 646 F.2d 527, 537, 209 USPQ 554, 564 (CCPA 1981)"

In the present case, it should be noted that the Bryant et al. (US 5,499,460) reference includes the following critical features in each of the base claims 1 and 13, and consequently in all of the issued claims 1-14:

> "wherein substantially all of said microcapsules are spaced apart from each other, the space between neighboring adjacent microcapsules comprising base material"

The prosecution history of Bryant et al. (US 5,499,460) shows that, after unsuccessfully prosecuting the parent application (837,762) and a subsequent file wrapper

continuing application (129,490), Bryant et al. added these critical features to the specification and the claims in order to gain allowance of the application by filing of a continuation-in-part application (275,226) on July 13, 1994. These limitations were, in fact, denied entry as new matter by the Examiner when Bryant et al. attempted to enter them by amendment into the 129,490 application on February 1, 1994. Thus, the issued claims were not supported by the original parent application or the subsequent continuing application, and therefore are only entitled to a 35 U.S.C. § 102(e) date of July 13, 1994, based on the filing date of the continuation-in-part application.

In the language of the Wertheim decision, a patent based on the original Bryant et al. parent application could not theoretically have issued the day the present application was filed. Therefore, the Bryant reference is not entitled to be used against the present application as 'secret prior art' under 35 U.S.C. 102(e) or under 35 U.S.C. § 103(a).

In conclusion, applicant respectfully requests that Examiner withdraw the rejections of claims 1, 5, 8, 9, 11 and 13-16 under 35 U.S.C. § 103(a) based on Bryant et al. (US 5,499,460).

12. Claims 1-11 and 13-18 were rejected under 35 U.S.C. § 102(e) as anticipated by Salyer (US 5,106,520) as evidenced by Bruemmer et al. (US 5,176,672).

13. Neither Salyer (US 5,106,520) nor Bruemmer et al. (US 5,176,672) disclose an article of clothing for use in a cold environment utilizing a phase change thermal storage material with a phase transition temperature that is between the environmental temperature and normal skin temperature and which is equal to or less than 82 degrees Fahrenheit in order to provide a thermal environment at a temperature above the ambient temperature for an extended period of time, and to provide a heat sink to absorb metabolic heat, the absorbed metabolic heat acting to recharge the phase change material, to thereby increase the time period for which the thermal storage material provides the thermal environment at a temperature above the ambient environmental temperature.

Therefore, no possible combination of these references could result in the claimed invention.

Claims 1-11 and 13-18 are therefore submitted as being patentable over Salyer (US 5,106,520) as evidenced by Bruemmer et al. (US 5,176,672) under 35 U.S.C. § 102(e).

14. Claims 17 and 18 were rejected under 35 U.S.C. § 103(a) as unpatentable over Bryant et al. (US 4,756,958).

15. As stated above, Bryant et al. (US 4,756,958) do not disclose or fairly suggest an article of clothing for use in a cold environment utilizing a phase change thermal storage material with a phase transition temperature that is between the environmental temperature and normal skin temperature and which is equal to or less than 82 degrees Fahrenheit in order to provide a thermal environment at a temperature above the ambient temperature for an extended period of time, and to provide a heat sink to absorb metabolic heat, the absorbed metabolic heat acting to recharge the phase change material, to thereby increase the time period for which the thermal storage material provides the thermal environment at a temperature above the ambient environmental temperature. Furthermore, as described above, the claimed invention exhibits unexpected results by extending the comfort time of the clothing article compared to the more conventional phase change storage fiber disclosed by Bryant et al. (US 4,756,958).

Claims 17 and 18 are therefore submitted as being patentable over Bryant et al. (US 4,756,958) under 35 U.S.C. § 103(a).

16. Claims 1, 4, 5, 8-11, 13 and 17-19 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 21-23 of Buckley (US 6,004,662).

17. A Terminal Disclaimer, which obviates the obviousness-type double patenting rejection, is submitted herewith.

18. Claims 1, 4-11, 13 and 17-19 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 2, 12, 14, 15, 19 and 23 of Buckley (US 6,319,599).

19. A Terminal Disclaimer, which obviates the obviousness-type double patenting rejection, is submitted herewith.

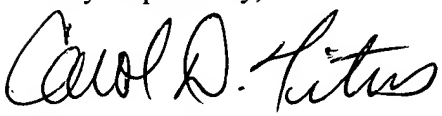
20. Claims 1-19 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-20 of copending application 09/990,236.

21. A Terminal Disclaimer, which obviates the obviousness-type double patenting rejection, is submitted herewith.

CONCLUSION

For all of the reasons given above, applicant submits that all of the claims pending in the present application are both novel and nonobvious. Allowance of such claims is submitted to be proper and is respectfully requested. If the Examiner deems that any further changes to the claims are necessary prior to allowance of the application, the Examiner is urged to initiate a telephonic interview with applicant's representative at the number listed below.

Very respectfully,



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AMENDED CLAIMS WITH MARKINGS TO SHOW CHANGES MADE

1. (amended) An article of clothing for metabolic cooling and for insulation of a user in a cold environment having an ambient environmental temperature which is below a comfortable skin temperature, said article comprising a thermal storage material capable of storing thermal energy as the latent heat of phase change dispersed therein, said thermal storage material having at least one phase transition at a temperature that is less than the maximum normal skin temperature but greater than ambient environmental temperature, said article to be placed in thermal contact with the skin of the user so as to provide a thermal environment at a temperature above said ambient environmental temperature for said user of said article for an extended time period, said thermal storage material further providing a heat sink to absorb metabolic heat of user, and said metabolic heat serving to recharge said thermal storage material, to thereby increase the time period for which said thermal storage material provides said thermal environment at a temperature above said ambient environmental temperature, said phase change material having a phase transition temperature equal to or less than 82 degrees Fahrenheit.

5. (amended) The article of clothing of claim 1, wherein said phase change material undergoes a solid-liquid transition.[.]